Multi-Channel Temperature Controller

By

Dr. Jeffrey W. Hudgens

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Temperature Control Electronics for HPLC System

LEDs signal the activity of the heaters. relative activity can quide the selection of cooler bath T & the position of the diversion valve for the warmer zones/

Temperature controller
(9-channels available but only 8-channels are used for this application)

USB connectors enable program control of the protease T's. See manual & vendor website

Valve controller
(Manual controls and indicators for 4 valves. CAT-5 connection on back)

Two protease T controls, which are easy to set manually.

Programming this device is challenging, but once set up, it rarely needs adjustment.

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1 Inch = 2.54 cm

STL File Inventory

Cable tethers.STL

Electric Sheild.STL

Valve Cable Anchor Plate.STL

Valve driver Mount_2x2.STL

Valve Handswich mount.STL

Valve Handswitch mount cap.STL

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Parts and Tools needed to Assemble T-Controller, Page 1/4

Item#	Part #	Description	Vendor	QNTY	NOTES
1	RTD-850	RTD Sensor with Miniature Threaded Housing	OMEGA Engineering	4	
2	SA1-RTD-4W	RTD Sensor, 4-wire, 40 Inches (1m), Stripped leads	OMEGA Engineering	3	May need only 2
	TX402	Thermocouple//RTD input head mount RFID temperature	OMEGA Engineering	5	
3		transmitter			
4	CN1507TH	7 CHANNEL CONTROLLER -- Thermistor input	OMEGA Engineering	1	
	CN32PT-440	1/32 DIN 4 Digit Display Controller with Two DC Pulse Outputs,	OMEGA Engineering	2	
5		110VAC			
	KHLV-0104/10-P	Thin film heater, 1'' x 2'' , 28 volts, 10W/in2 Polyimide Film heater	OMEGA Engineering	3	
6		with PSA			
	KHLV-0502/10-P	Thin film heater, 0.5'' x 4'' , 28 volts, 10W/in2 Polyimide Film	OMEGA Engineering	7	
7		heater with PSA			
	KHLV-2/10-P	Thin film heater, 2'' dia, 28 volts, 10W/in2 Polyimide Film heater	OMEGA Engineering	1	
8		with PSA			
	KHLV-0504/10-P	Thin film heater, 0.5'' x 4'' , 28 volts, 10W/in2 Polyimide Film	OMEGA Engineering	2	
9		heater with PSA			
	KHLV-0105/10-P	Thin film heater, 1'' x 5'' , 28 volts, 10W/in2 Polyimide Film heater	OMEGA Engineering	1	
10		with PSA			
	KHLV-102/10-P	1"w x 2"L, KHLV Series, Rectangular, 28 Volts, Kapton Insulated	OMEGA Engineering	4	
11		Heaters with PSA			
12	SA1-TH-44004-40-T	Thermistor, 2252 Ohms at 25°C, 1 meter (40") of Cable	OMEGA Engineering	2	
13	ON-950-44004	Thermistor, 2252 Ohms at 25°C, 305 mm PFA leads	OMEGA Engineering		
14	SA1-TH-44004-40-T	Thermistor, 2252 Ohms at 25°C, 1 meter (40") of Cable	OMEGA Engineering	3	
15	PT-USB-CABLE	USB Micro to Standard Cable with Panel Mount Connector	OMEGA Engineering	2	
	SSR-RACK08	Solid State Relay Backplane (Gordos/OPTO-22 Type Relays), 8-	Measurement Computing	1	also available from OMEGA Engineering and
16		Channel			other vendors.
	SSR-ODC-05	Solid State Relay Module, Single, DC Switch, 3 to 60 VDC @ 3.5 A	Measurement Computing	5	also available from OMEGA Engineering and
17					other vendors.
	CIO-MINI37	Universal screw-terminal board, 37-pin	Measurement Computing	1	also available from OMEGA Engineering and other vendors. Do not confuse this board with others of the same part number.
18					
	C37FF-1	Cable, 37-conductor ribbon, female to female, 1 ft.	Measurement Computing	1	also available from OMEGA Engineering and
19					other vendors.
	999101	UPLCF Cable – Female DB37 Bulkhead Connector with Labeled 22	Ardara Technologies LP		https://www.ardaratech.com/
20		Gauge Two-wire and Four-wire Cable Assemblies with Flying Leads at the Ends.			
	999102	UPLCM Cable – Male DB37 Bulkhead Connector with Labeled 22	Ardara Technologies LP		https://www.ardaratech.com/
21		Gauge Two-wire and Four-wire Cable Assemblies with Flying Leads at the Ends.			
	999103	UPLCP2P Cable – Point-to-Point Female DB37 to Male DB37 Cable	Ardara Technologies LP		https://www.ardaratech.com/
22		assembly, consisting of Labeled 22 Gauge Two-wire and Four-wire Cables.			
	1144-1026-ND	Single Phase EMC/EMI Line Filter 10A 115V, 250V Rated AC	Digikey, www.digikey.com	1	Mount to back panel
23		50/60Hz Single Stage Wire Leads			
24	HM1007-ND	CHASSIS 13X16.6X3.5" BLACK (Hammond RM2U1913VBK)	Digikey	1	

1 Inch = 2.54 cm

Parts and Tools needed to Assemble T-Controller, Page 2/4

25	HM1334-ND	PAIR HANDLE 2" STEEL BLACK (Hammond 1427E1BK)	Digikey	1	
	1145-1126-ND	AC/DC CONVERTER 24V 320W (MFR# PMF-24V320WCGB)	Digikey	1	Main PS for heaters & 7-channel controller.
26					
	1053-1093-ND	FAN AXIAL 80X27MM 115VAC WIRE (MFR. OA825AP-11-1WB)	Digikey	1	Use 3D-printed "fan adapter" to obtain proper fit.
27					
28	WMG80B	FAN GUARD 80MM WIRE MESH BLACK	Digikey	1	
29	G80-18B	FAN GUARD METAL 80MM BLACK	Digikey	1	
30	36-7313-ND	TERMINAL LOCKWASHER LUG #8 ANGLE	Digikey	10	
31	36-7315-ND	TERMINAL LOCKWASHER LUG #6 ANGLE	Digikey	10	
32	36-2210-ND	HEX STANDOFF 6-32 ALUMINUM 1/2"	Digikey	8	
33	H747-ND	MACHINE SCREW PAN PHILLIPS M4, PkG/100	Digikey	1	
	1470-1149-ND	AC/DC CONVERTER 5V 1A (Mfr. ECL05US05-T)	Digikey	2	Mount 1 to back panel; mount 1 to base panel near the 7-channel controller
34					
35	A98076-ND	TERM BLOCK 2POS SIDE ENTRY 5MM	Digikey	4	
36	A98339-ND	TERM BLOCK 6POS SIDE ENTRY 5MM (MFR. 282836-6)	Digikey	3	
37	SJ5007-0-ND	BUMPER SQU 0.413"L X 0.413"W BLK	Digikey	8	
38	SJ5003-0-ND	BUMPER CYLINDRICAL 0.44" DIA BLK	Digikey	4	
39	360-1733-ND	SWITCH ROCKER DPST 9A 125V	Digikey	1	
40	PB529-ND	CIR BRKR THRM 10A 125VAC 50VDC	Digikey	1	
41	PB528-ND	CIR BRKR THRM 5A 125VAC 50VDC	Digikey	1	
42	Q209-ND	PWR ENT RCPT IEC320-C14 PANEL QC	Digikey	2	
43	RC14JB100R-ND	RES 100 OHM 1/4W 5% AXIAL	Digikey		
	Y0785-500A-ND	500 Ohm ±0.01% 0.6W Through Hole Resistor Radial Moisture	Digikey	6	voltage drop for RTD circuits (requires
44		Resistant, Non-Inductive Metal Foil			reference quality resistor)
	CLA383-ND	OPTOISO 3.75KV 2CH OPEN DRN 8DIP (Mfr #	Digikey	10	Final version of isolator board
45		CPC5002G)			
46	1175-1467-ND	CONN IC DIP SOCKET 8POS GOLD	Digikey	10	
	A121350-ND	TERM BLOCK RCPT 2POS VERT .100	Digikey	10	Probably need 4. Used for +5VDC connections.
47					
	609-3942-ND	TERM BLOCK 8POS 5.08MM PCB HORIZ	Digikey	8	Handy for point-to-point wiring boards.
48					Probably need 4.
49	BZX85C3V6-ND	Zener Diode 3.6V 1W ±6% Through Hole DO-41	Digikey	20	Not sure where these were used.
	BC1148CT-ND	CAP CER 0.1UF 25V Y5V RADIAL	Digikey	100	I use these a lot in some circuits, but you
50					probably need fewer--likley 10.
51	1N4615-1-ND	DIODE ZENER 2V 500MW DO7	Digikey	4	
	1655-1358-1-ND	Diode Standard 75V 300mA (DC) Through Hole DO-35	Digikey	30	I think these are used in the optoislation
52					circuits.
53	CLA383-ND	OPTOISO 3.75KV 2CH OPEN DRN 8 DIP	Digikey	4	
54	V1044-ND	PC BOARD 3-HOLE SLDR PAD 4.5X6.5	Digikey	2	probably didn't use
55	CF14JT10K0CT-ND	RES 10K OHM 1/4W 5% AXIAL	Digikey	20	
56	RS212-ND	Resistor Kit 1-1M 1/6W, 365 pcs	Digikey	1	Don't need this, but it is handy to have.
57	CF14JT1K00CT-ND	RES 1K OHM 1/4W 5% AXIAL	Digikey	20	
58	CF14JT330RCT-ND	RES 330 OHM 1/4W 5% AXIAL	Digikey	20	
59	CF14JT680RCT-ND	RES 680 OHM 1/4W 5% AXIAL	Digikey	20	
	CP-1238-ND	8 Position Circular Connector Receptacle, Female Sockets Solder	Digikey	2	Used for aux heaters on valve shafts
60		Silver			

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Parts and Tools needed to Assemble T-Controller, Page 3/4

61	CP-1038-ND	8 Position Circular Connector Plug, Male Pins Solder	Digikey	2	Used for aux heaters on valve shafts
	361-1257-ND	8 Position Circular Connector Receptacle, Female Sockets Solder	Digikey	2	Used for aux heaters on valve shafts
62		Cup Silver			
	CDPM1002-ND	Linear AC DC Converter 1 Output 24V 100mA 120VAC Input	Digikey	5	Used to power RTD's. Don't even think about buying a bigger PS to power all RTD circuits. *Each RTD circuit must float* , absent reference to a common ground.
63					
	361-1232-ND	8 Position Circular Connector Plug, Male Pins Solder Cup Silver	Digikey	2	
64					
	W126-50-ND	8 Conductor Multi-Conductor Cable Gray 22 AWG 50.0' (15.24m)	Digikey	1	
65					
66	A98514-ND	CONN BARRIER STRIP 2CIRC 0.437"	Digikey	5	
	486-1618-ND	CIR BRKR THRM 1A 240VAC 32VDC	Digikey	1	Probably used on RTD supply rack, located on HPLC casing.
67					
68	CH779-ND	SWITCH ROCKER DPST 10A 125V	Digikey	2	
69	36-7315-ND	CONN TERM LUG LOCKWASHR #6 ANGLE	Digikey	40	use to terminate PS wiring at barrier strips
70	36-918-ND	CONN TERM LUG LOCKWASHER #6 FLAT	Digikey	30	use to terminate PS wiring at barrier strips
71	WM5928-ND	CONN QC RCPT 18-22AWG 0.187	Digikey	15	
72	WM18230-ND	CONN QC RCPT 18-22AWG 0.250	Digikey	15	
	A32503-ND	15 Position D-Sub Plug, Male Pins Connector, Free Hanging (In-	Digikey	4	
73		Line) Solder Cup			
	626-1032-ND	15 Position D-Sub Receptacle, Female Sockets Connector, Free	Digikey	5	
74		Hanging (In-Line) Solder Cup			
	976-37RPE-ND	37 Position Two Piece Backshell Connector Gray 180° Unshielded	Digikey	2	
75					
76	1003-1038-ND	SCREW LOCK FEMALE PANEL MNT 4-40	Digikey	4	
77	WM2290CT-ND	Contact Crimp Pin 18-24 AWG Gold	Digikey	32	
78	WM1008-ND	Contact Crimp Socket 18-24 AWG Gold	Digikey	20	
79	67-1190-ND	LED 3MM HI-I RED DIFF6"LDS PNLMT	Digikey	10	
80	CF14JT1K00CT-ND	RES 1K OHM 1/4W 5% CARBON FILM	Digikey	20	
	455-1165-ND	2 Position Rectangular Housing Connector Receptacle Natural	Digikey	3	
81		0.079" (2.00mm)			
	455-1126-ND	3 Position Rectangular Housing Connector Receptacle Natural	Digikey	3	
82		0.079" (2.00mm)			
83	455-1127-1-ND	CONN TERM CRIMP PH 24-30AWG	Digikey	20	
	M9935CT-ND	ion LC (T-Type) EMI Filter 3rd Order Low Pass 1 Channel R = 0.05	Digikey	2	Didn't use but it is recommended for power supply filtering
84		Ohms, C = 0.01µF 5A Radial - 3 Leads			
	1144-1026-ND	Single Phase EMC/EMI Line Filter 10A 115V, 250V Rated AC	Digikey	1	
85		50/60Hz Single Stage Wire Leads			
		Molex 4-Pin Connector Kit 0.093" 2 Sets	www.amazon.com	1	Used to senset and power the protease assemblies
86					
87	2206281	Stranded and Solid hook up wire kits, #18, stranded	James Electronics Limited	1	
88	2202394	5 Foot 3 Conductor Detachable Power Cord	James Electronics Limited	1	
	489475	Quick Disconnect Terminal 18-22 AWG Female 22.6mm 9.65mm	James Electronics Limited	10	
89		Electro-tin Loose Piece			

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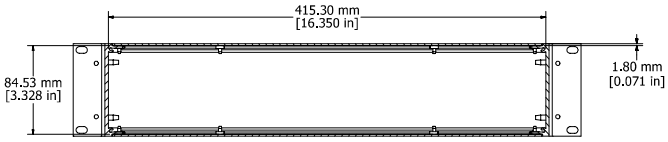
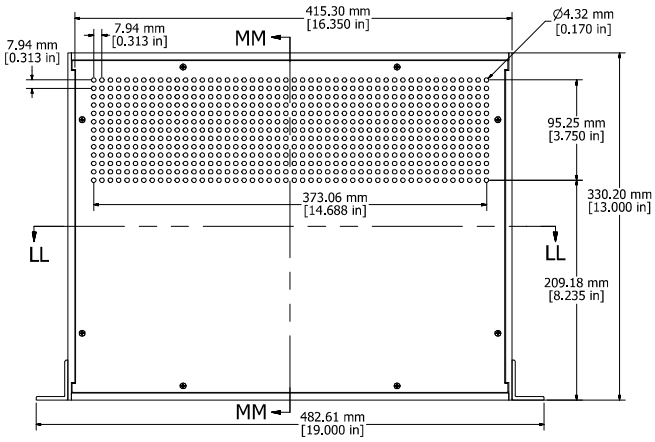
Parts and Tools needed to Assemble T-Controller, Page 4/4

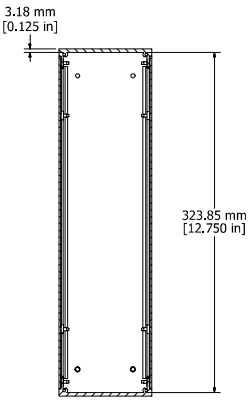
	489635	Quick Disconnect Terminal 18-22 AWG Female 19.81mm 8.02mm	James Electronics Limited	10	
90		Electro-tin Loose Piece			
	Tools				
91	WM8423-ND	KIT QUICK DISCONNECT K-181	Digikey	1	Most workbenches have this tool
92	TX400-RFID	RFID programmer	OMEGA Engineering	1	Absolutely required



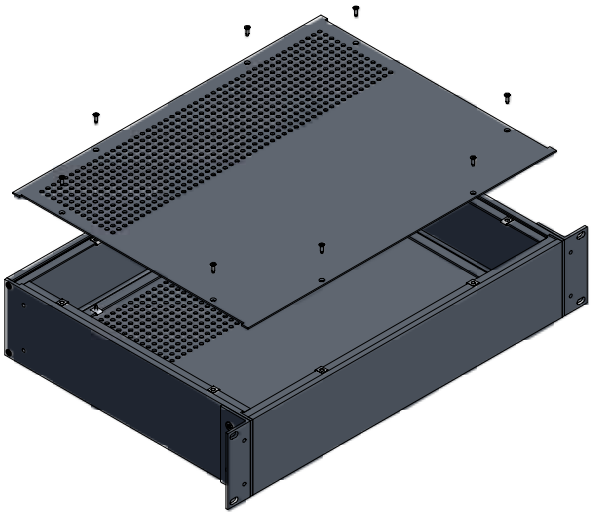
SECTION LL-LL



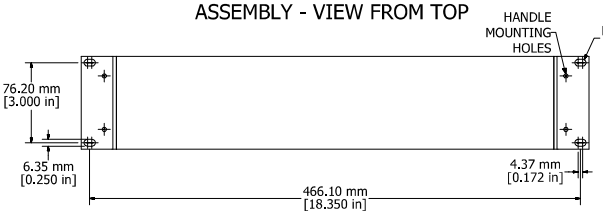
ASSEMBLY - VIEW FROM TOP



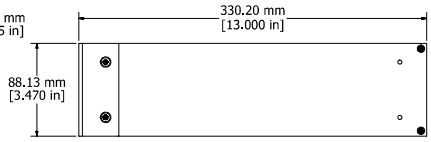
SECTION MM-MM



RM2U1913VBK	
Extruded Aluminum Frame - Type 6063	
2 Panels - .064" Aluminum (5052-H32) Powder Coat	
2 Mounting Brackets - .125" Aluminum	
16 Screws - Flat Head 4-40 x 3/8"	
8 Screws - Counter Sunk Head 6-32 x 3/8"	
4 Screws - Counter Sunk Head 10-32 x 3/8"	
16 Nuts - #4 Speed Nuts	
Four Self Adhesive Rubber Feet - 1421T3	
ACCESSORIES	
PULL HANDLES	1427E1BK



ASSEMBLY - VIEW FROM FRONT



ASSEMBLY - VIEW FROM SIDE

Enclosures can be Factory Modified (Milling, Drilling, Printing etc.)
Contact Factory mjm@hammondmfg.com for quotes
Solid models of this enclosure available in STEP or IGES.

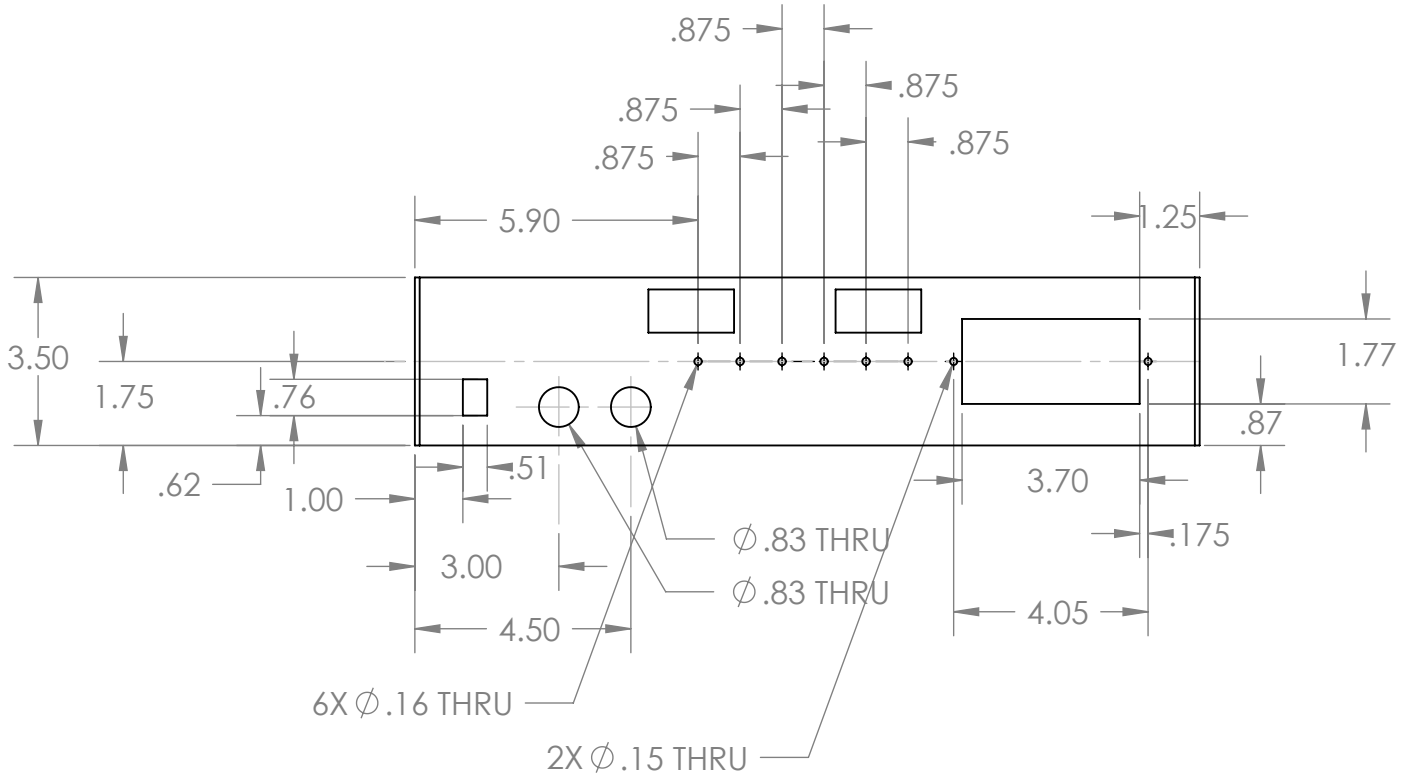
HAMMOND MANUFACTURING™

RM2U1913VBK

www.hammondmfg.com

2U Size Aluminum Box used to Construct T-Controller

1 Inch = 2.54 cm



UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL
FINISH
NEXT ASSY | USED ON
APPLICATION | DO NOT SCALE DRAWING

	NAME	DATE
DRAWN		
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

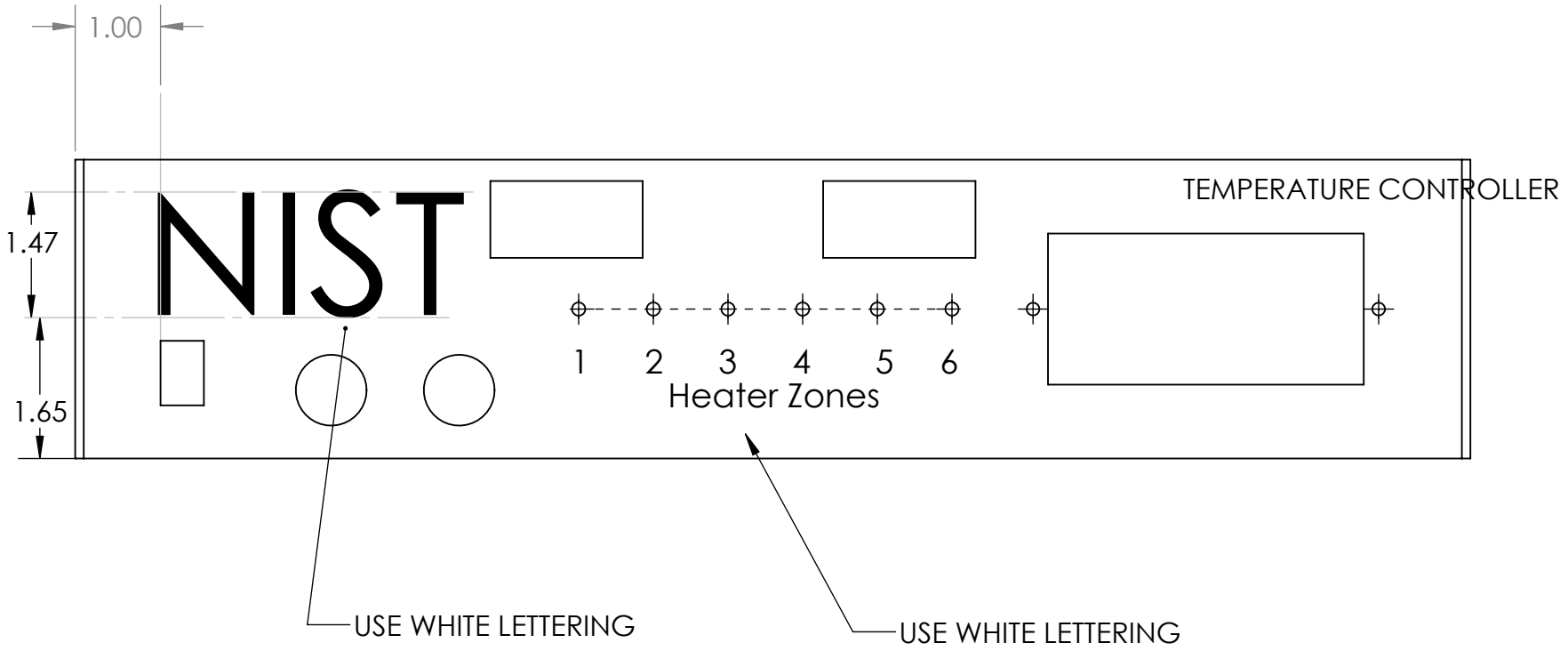
TITLE:

Front Panel 1/09/2017

SIZE A | DWG. NO. Power Box Face | REV

SCALE: 1:4 WEIGHT: SHEET 1 OF 4

1 Inch = 2.54 cm



NOTE: Use font similar to Arial or Century Gothic. Choose font size in accord with schematic..

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		TOLERANCES: FRACTIONAL ±	CHECKED		
		ANGULAR: MACH ± BEND ±	ENG APPR.		
		TWO PLACE DECIMAL ±	MFG APPR.		
		THREE PLACE DECIMAL ±	Q.A.		
		INTERPRET GEOMETRIC TOLERANCING PER:	COMMENTS:		
		MATERIAL			
		FINISH			
NEXT ASSY	USED ON				
APPLICATION		DO NOT SCALE DRAWING			

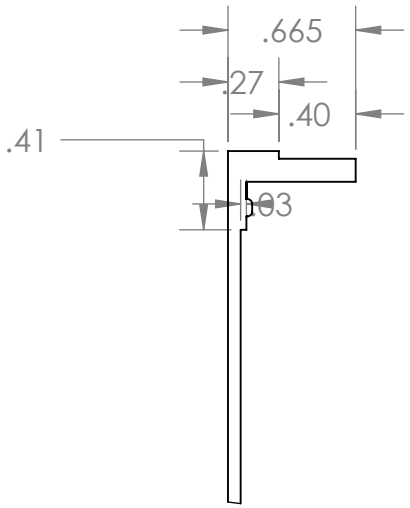
TITLE: Lettering on Front Panel

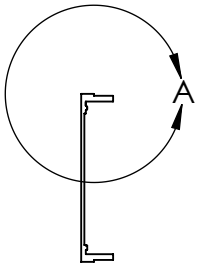
SIZE A | DWG. NO. | REV

Power Box Face

SCALE: 1:4 WEIGHT: SHEET 2 OF 4

1 Inch = 2.54 cm





DETAIL A
SCALE 1 : 1

UNLESS OTHERWISE SPECIFIED:

	NAME	DATE
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CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL
FINISH

NEXT ASSY | USED ON
APPLICATION | DO NOT SCALE DRAWING

TITLE:

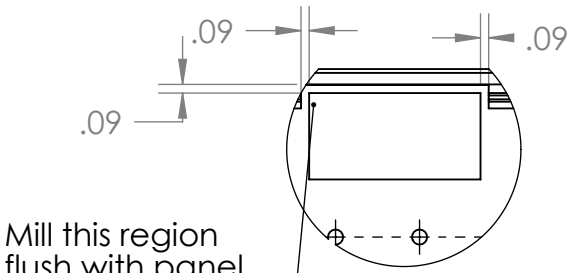
Power Box Face Detail

SIZE A | DWG. NO. | REV

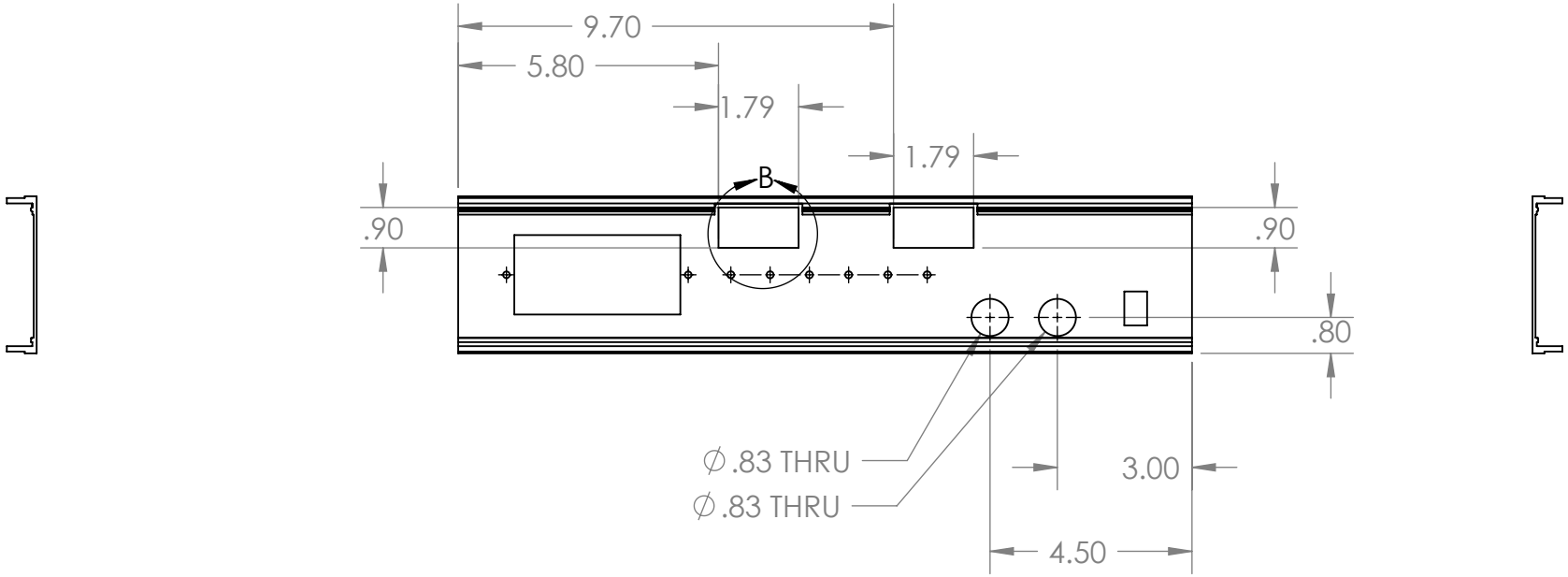
Power Box Face Detail

SCALE: 1:4 WEIGHT: SHEET 3 OF 4

1 Inch = 2.54 cm



DETAIL B
SCALE 1 : 2



UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL
FINISH

NEXT ASSY | USED ON
APPLICATION | DO NOT SCALE DRAWING

	NAME	DATE
DRAWN		
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

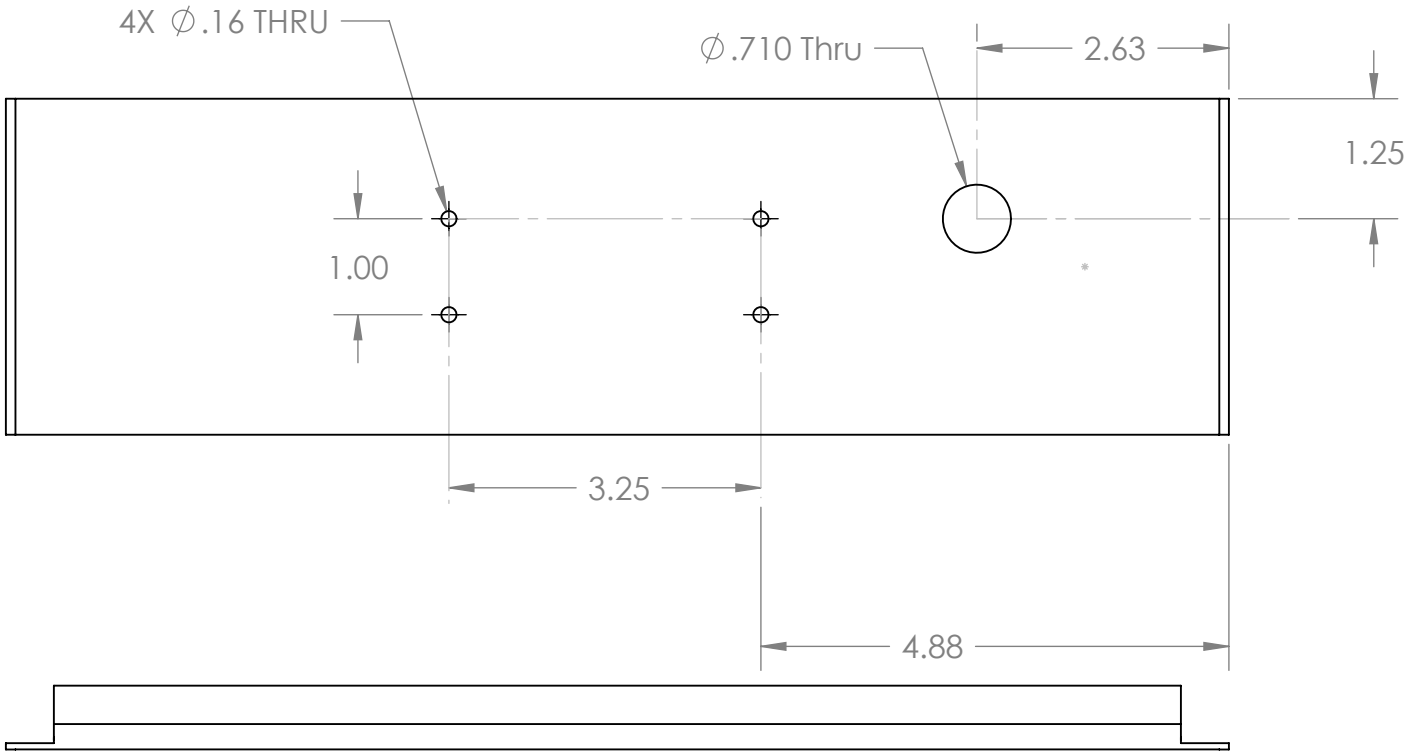
TITLE:
REAR View of Front Panel 1/09/2017

SIZE A | DWG. NO. | REV

Power Box Face

SCALE: 1:4 WEIGHT: SHEET 4 OF 4

1 Inch = 2.54 cm



UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL
FINISH

NEXT ASSY | USED ON

APPLICATION | DO NOT SCALE DRAWING

	NAME	DATE
DRAWN		
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

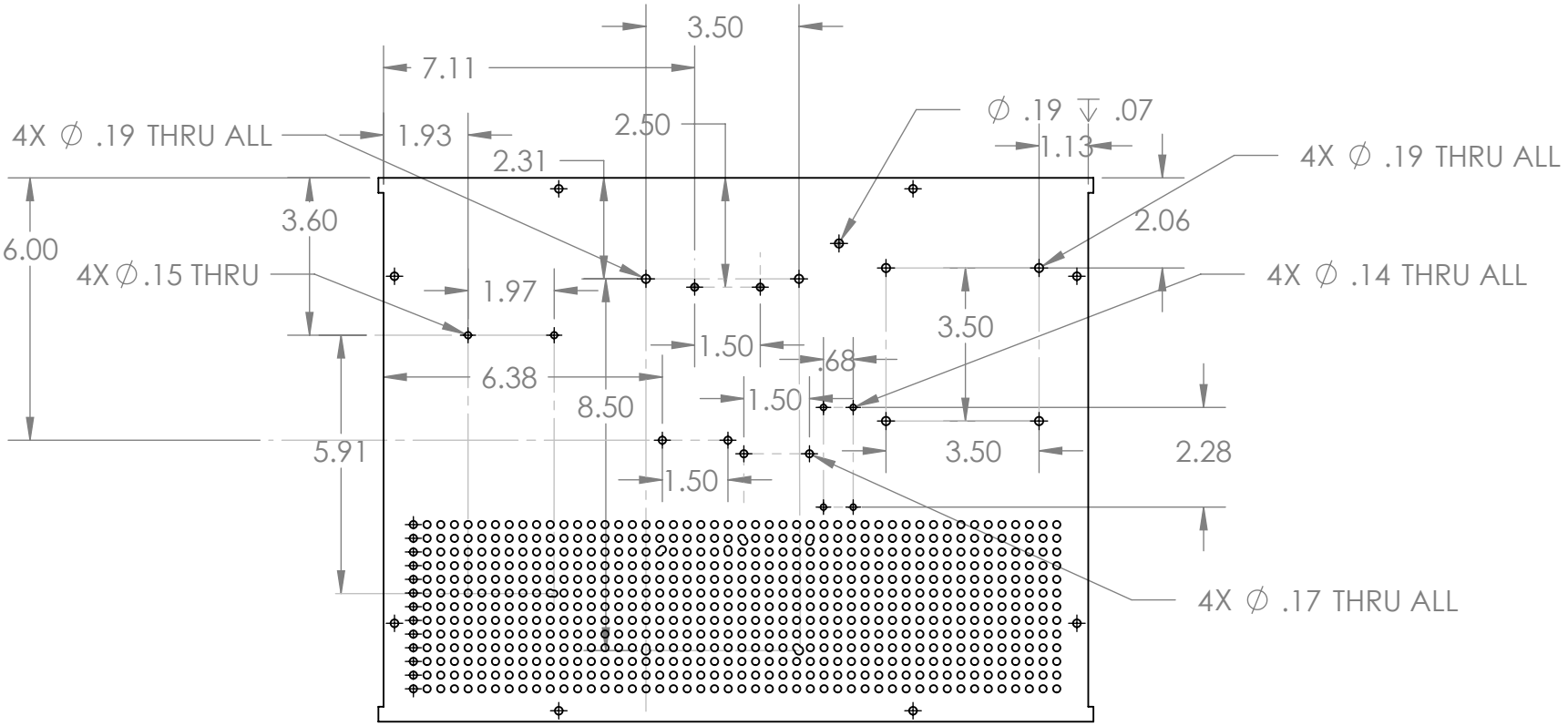
TITLE:

SIZE A | DWG. NO. | REV

Power Box Right Side

SCALE: 1:4 WEIGHT: SHEET 1 OF 1

1 Inch = 2.54 cm



		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ± THREE PLACE DECIMAL ±	DRAWN		
			CHECKED		
			ENG APPR.		
			MFG APPR.		
			Q.A.		
		INTERPRET GEOMETRIC TOLERANCING PER:	COMMENTS:		
		MATERIAL			
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

TITLE:

Chassis Bottom Plate (hole locs)

SIZE	DWG. NO.	REV
A		

SCALE: 1:8 | WEIGHT: | SHEET 1 OF 2

1 inch = 2.54 cm

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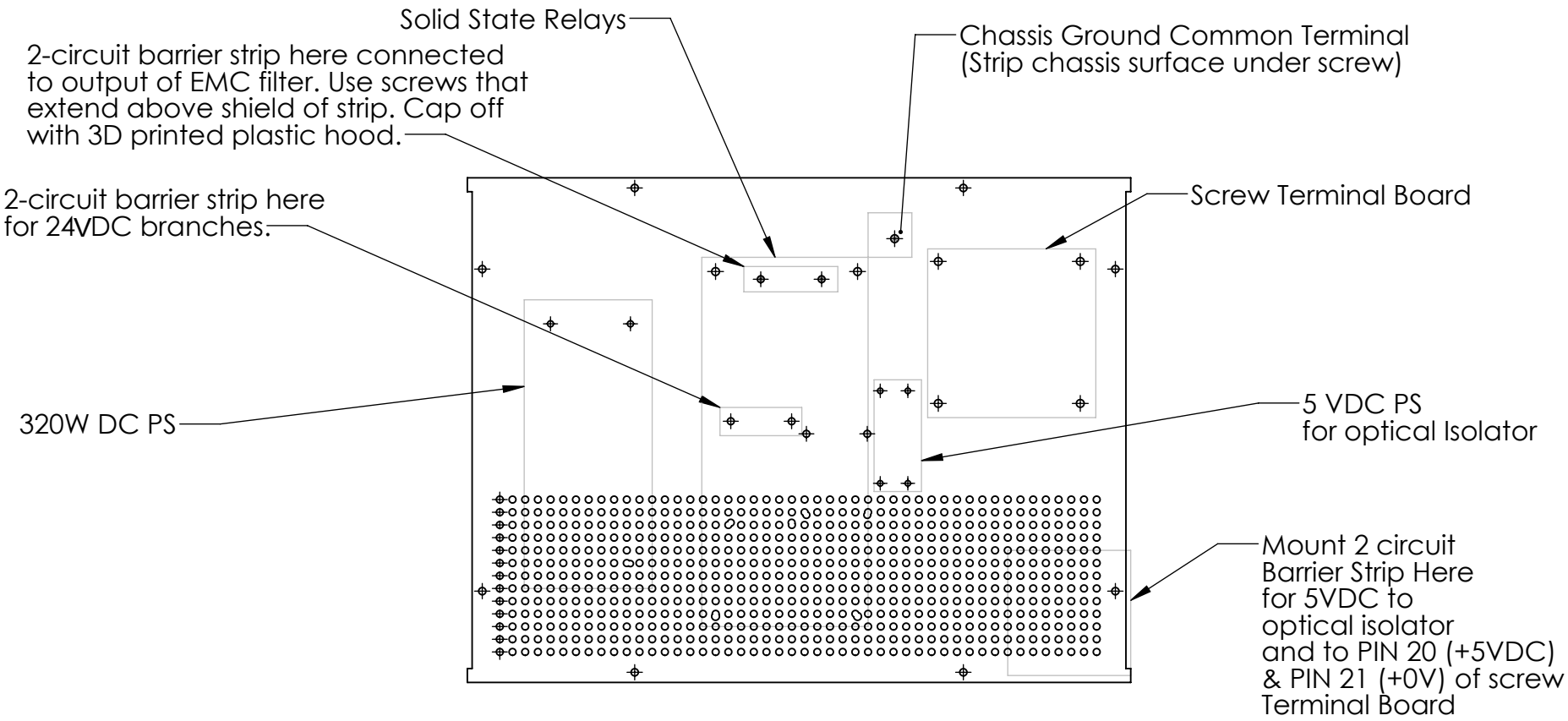


		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ± THREE PLACE DECIMAL ±	DRAWN		
			CHECKED		
			ENG APPR.		
			MFG APPR.		
			Q.A.		
		INTERPRET GEOMETRIC TOLERANCING PER:	COMMENTS:		
		MATERIAL			
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

TITLE: Function Callout for Bottom Plate

SIZE	DWG. NO.	REV
A		

SCALE: 1:8 | WEIGHT: | SHEET 2 OF 2

1 inch = 2.54 cm

Temperature controller internal layout

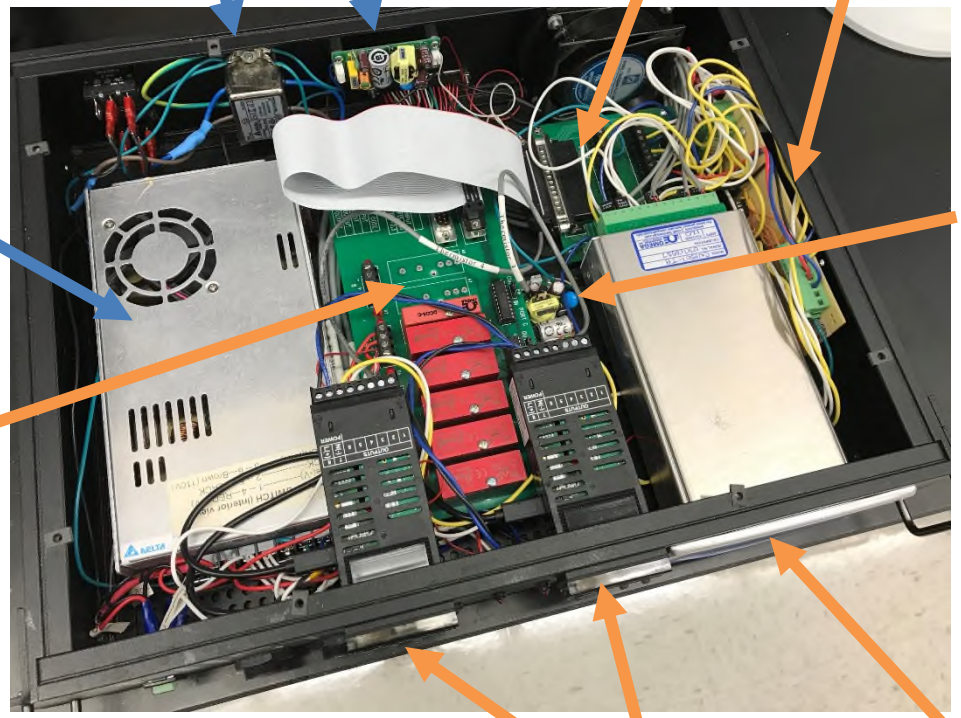
Single Phase EMC/EMI Line Filter 10A 115V

5 VDC PS for 2 fans

MINI37 screw-terminal board, 37-pin

Optical isolator Interpreter board between 7-channel controller, both protease T controllers, & the screw-terminal board

Heater Power:
24V 320W



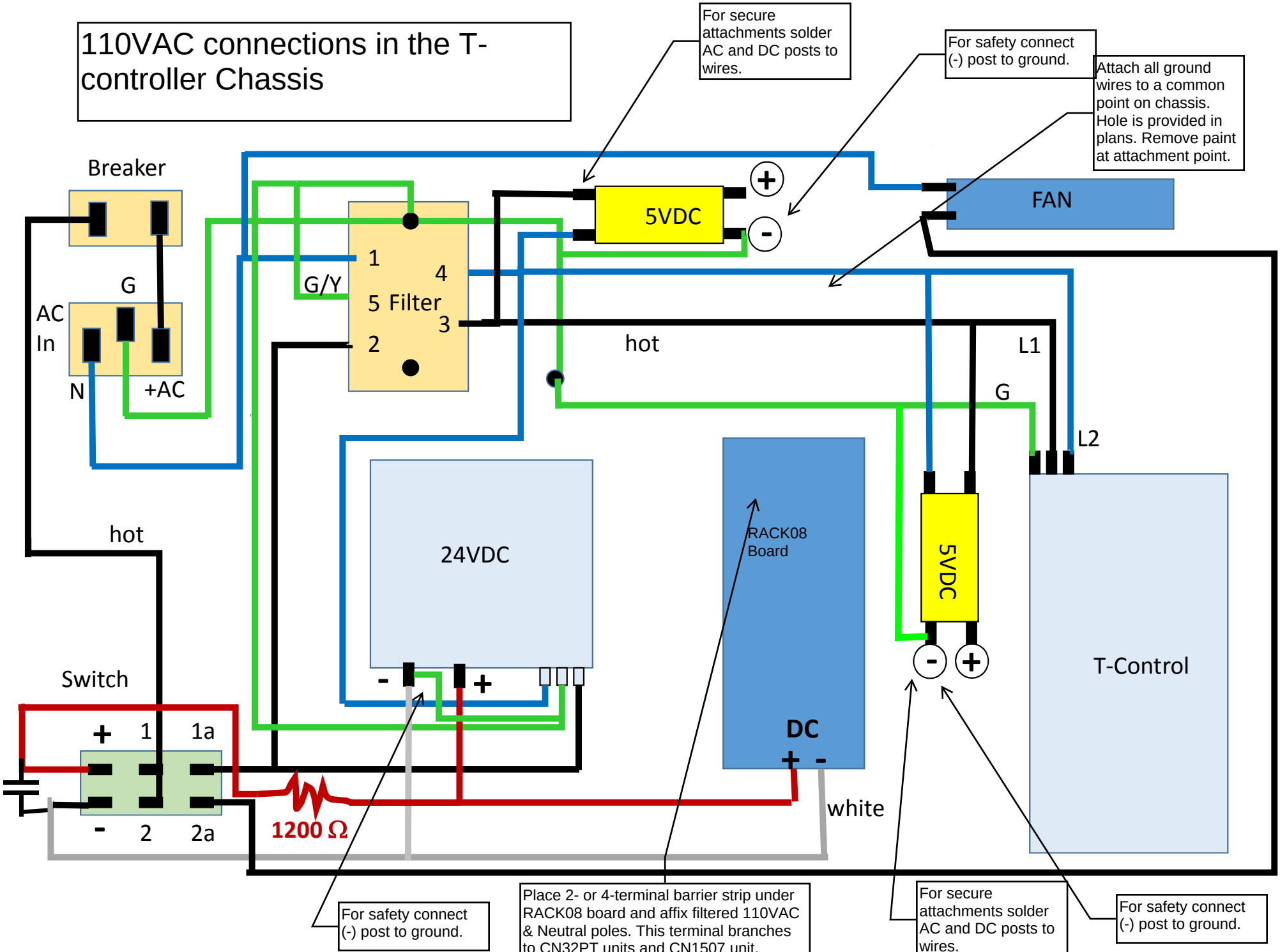
5 VDC PS for Optical isolator Interpreter board

8-Channel Solid State Relay Backplane (6 channels are used)

Protease T-controllers

7-channel controller (5 channels are used)

110VAC connections in the T-controller Chassis



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1 Inch = 2.54 cm

Temperature controller
(Rear/side views)

8-pin connector for sensing & controlling T in zone, which are valve shaft housing temperatures.

Depending on how the interior area is milled and cut, you may find a poor fit for the fan. If so, print the file, "Fan Adapter,STL", which can provide a satisfactory fit.

37-pin D-sub connector for sensing temperatures in 7 zones, controlling T in 4 zones, fan power, & housing ground.

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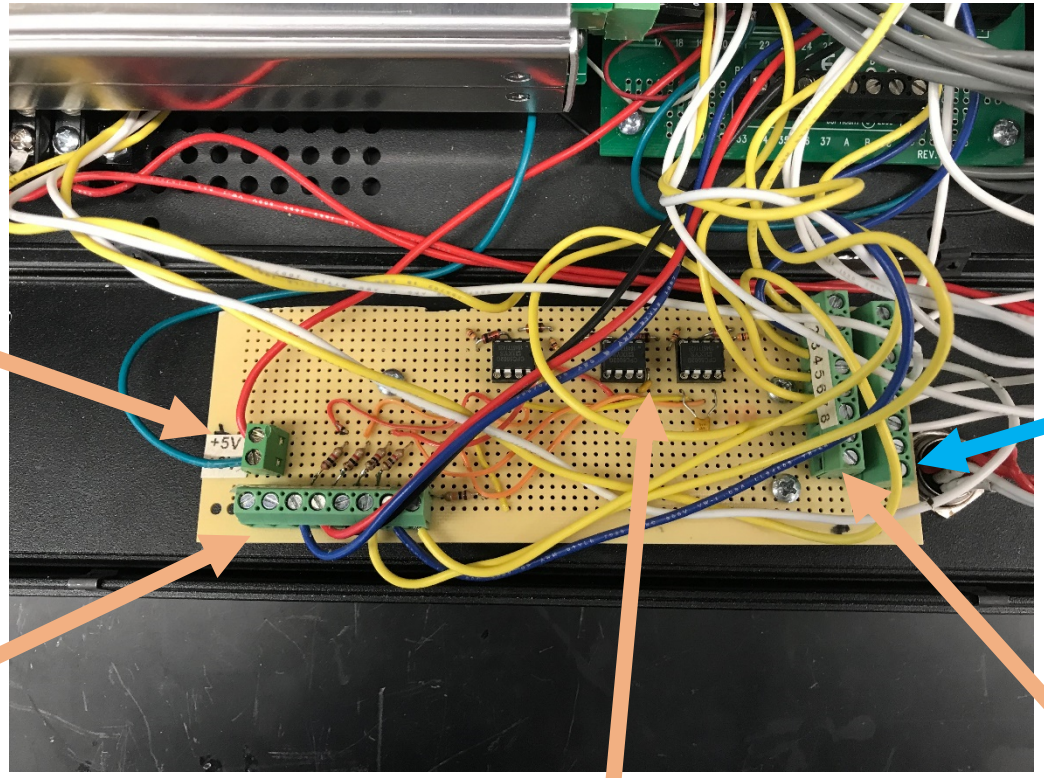
View of Optical Isolator Interpreter Board



Input for +5VDC from 5VDC PS #2

Output signal to MINI37 screw terminal board

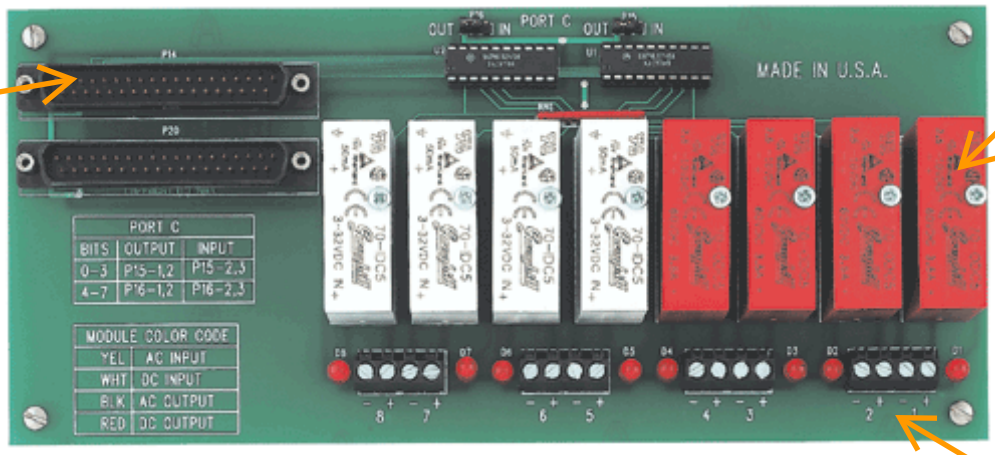
(-) terminals on CN1507 outputs

(+) terminals on CN1507 outputs

2-channel opto-isolator (Digikey# CLA383-ND, Mfr #CPC5002G). **NOTE:** I tried three other isolator circuits and chips. This is the one that works.

SSR-RACK08

Eight-Channel Solid-State Relay (OPTO22, Gordos) Mounting & Interface Rack

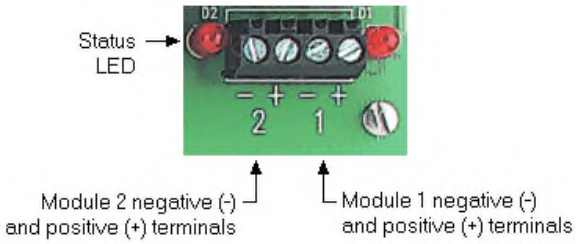


Functional description

The SSR-RACK08 is a mounting and interface rack for use with industry-standard size solid state I/O modules. These modules provide 1500 V of isolation from harsh electrical environments for both digital inputs and outputs. Onboard TTL-level drivers provide the necessary drive current to control any compatible 5 V solid-state relay. The SSR senses (input) and switches (output) AC and DC voltages.

Screw terminal wiring

Each SSR-RACK08 module has two independent screw terminals. Use 12-22 AWG wire to connect signals to the screw terminals. The status LED is ON when a module is active.



The screw terminal/module numbers correspond to 8255 ports:

- 1 to 4 correspond to PORT C Low Bit 0 to 3
- 5 to 8 correspond to PORT C High bits 4 to 7

Module input/output control OUT/IN jumpers

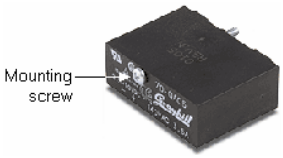
Two jumpers are provided to set the module type for PORT C High and PORT C Low.

- The jumper labeled **P15** controls modules 1 through 4, which are controlled by PORT C Low bits (bit 0 through bit 3).
- The jumper labeled **P16** controls modules 5 through 8, which are controlled by PORT C High bits (bit 4 through bit 7).

You cannot mix input and output modules within a group.

Solid-state I/O modules

The SSR-RACK24 has eight mounting positions for solid state I/O modules manufactured by Gordos, OPTO22, Grayhill, Western Digital, and others. These modules provide 1500 V of isolation from harsh electrical environments for both digital inputs and outputs. Mounting screw threads are provided for you to easily install the SSR modules. An example of an SSR module and mounting screw is shown below.



Contact MCC for compatible modules from the SSR-OAC, SSR-ODC, SSR-IAC and SSR-IDC module series.

1 Inch = 2.54 cm

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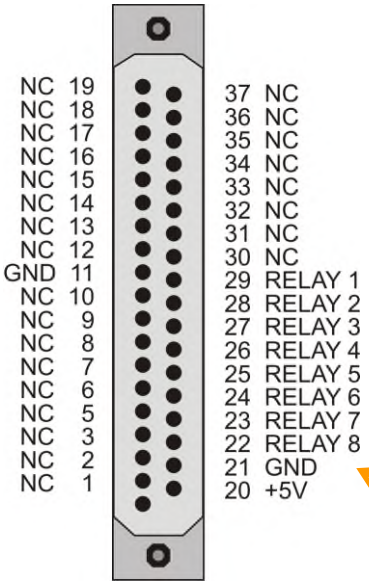
37-pin connectors

The SSR-RACK08 has two 37-pin D connectors labeled **P14** and **P20** on the board. Most pins are wired 1:1, although pins 1, 2, and 11-19 are not passed through. A typical interface connector pin out is shown below.



Use C37FF-x cables to connect with compatible MCC 24-bit digital I/O boards, such as the USB-DIO24/37. The 2nd connector is provided to access the remaining board connections.

Onboard buffers

Because most manufacturers of SSR racks do not supply output buffers on the SSR rack, simple digital I/O boards such as the PCI-DIO24, PCI-DIO96, and other manufacturer's 82C55-based digital I/O boards do not have the power to switch the SSRs. For example, to use an OPTO22 PB16 rack, you need to use a high-drive DIO board such as the PCI-DIO24H or PCI-DIO96H.

In order to be usable with all common TTL output boards, the SSR-RACK08 is designed with onboard buffers. With these buffers, you can plug directly into the SSR-RACK08 from your PCI-DIO24, PCI-DIO96, or any other manufacturer's 82C55-based digital I/O board.

SSR-RACK inverting logic

On an input SSR, the presence of a voltage raises the TTL output of the SSR from TTL low to TTL high. Because the SSR-RACK uses the conventional inverting logic, the completed circuit of SSR and SSR-RACK lowers the signal to the DIO board from TTL high (+5) to TTL low (GND). An output SSR completes a circuit when the DIO board TTL signal to the SSR is low. The circuit through the SSR is open when the signal from the DIO board is high.

Converting the SSR-RACK from inverting logic

The SSR-RACK follows the convention set by OPTO22 and followed by virtually all SSR rack manufacturers — the sense and control logic for the relays is inverted. This means that a 0 output from the digital I/O board causes an output relay to activate (complete the circuit), while a 1 (TTL high) causes the relay to deactivate. The chips which invert the logic are socketed and can be easily replaced with chips that do not invert the logic. Discuss your order with a technical sales engineer if you need non-inverting logic.

These pins correspond to the screw terminals on the CIO-MINI37 board.

1 Inch = 2.54 cm
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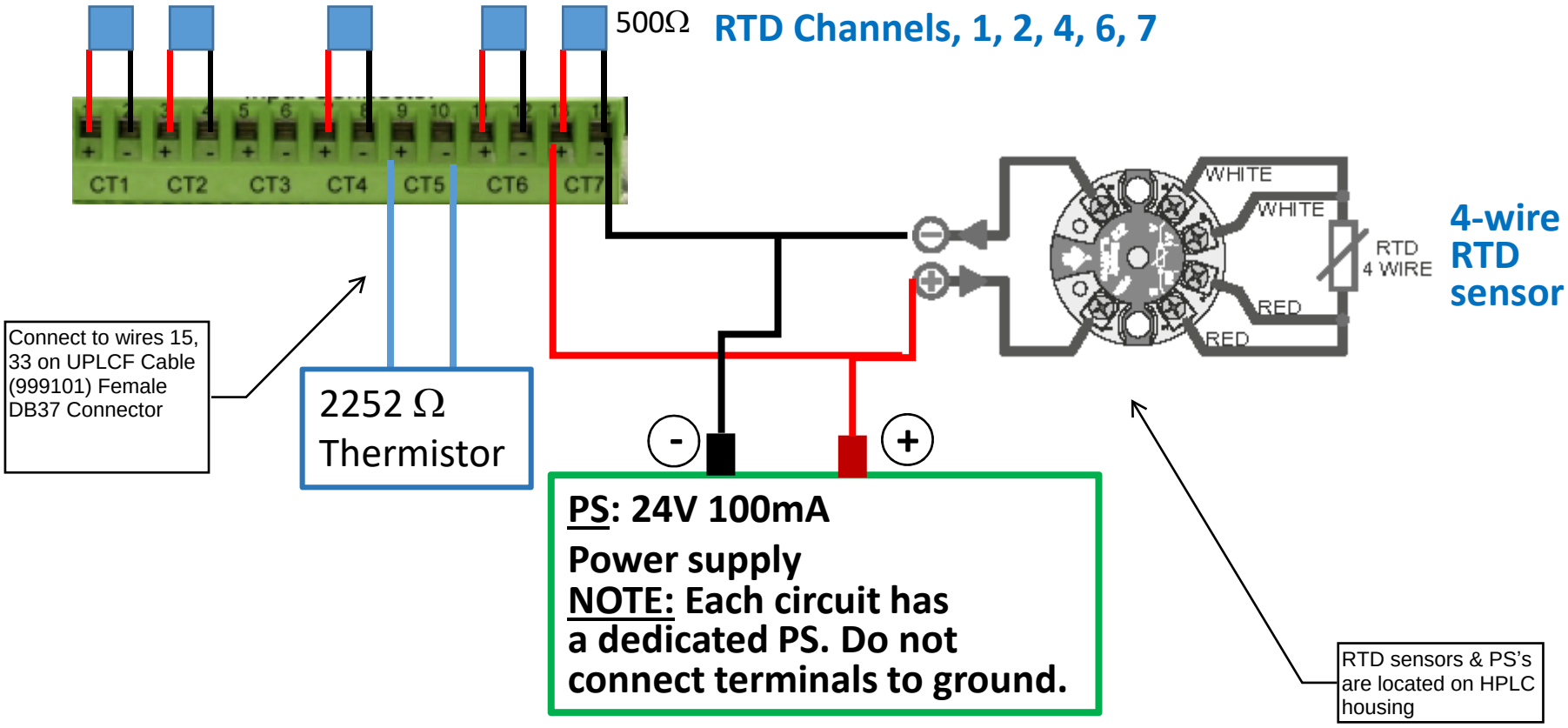
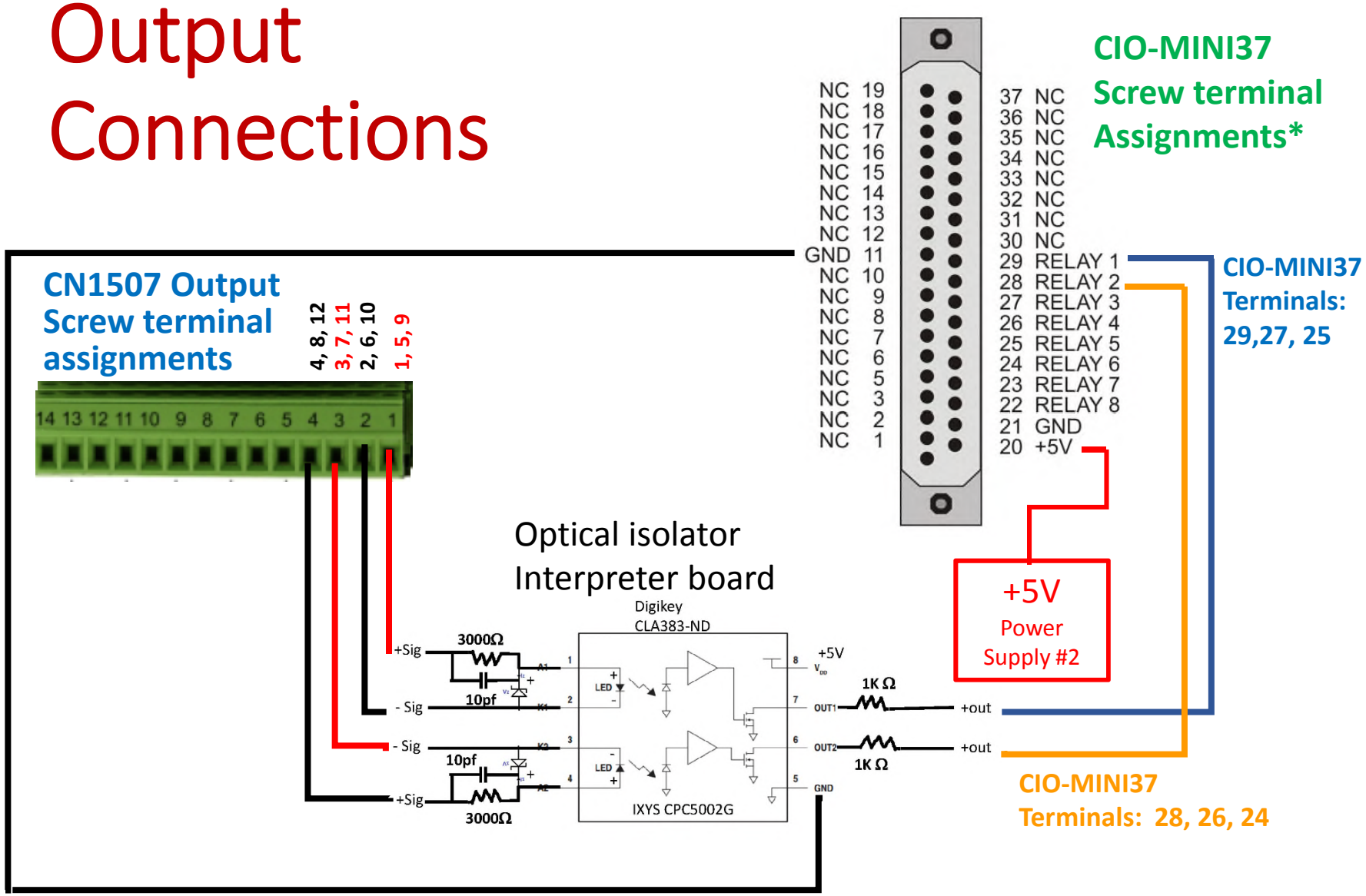
CN1507TH Input connections

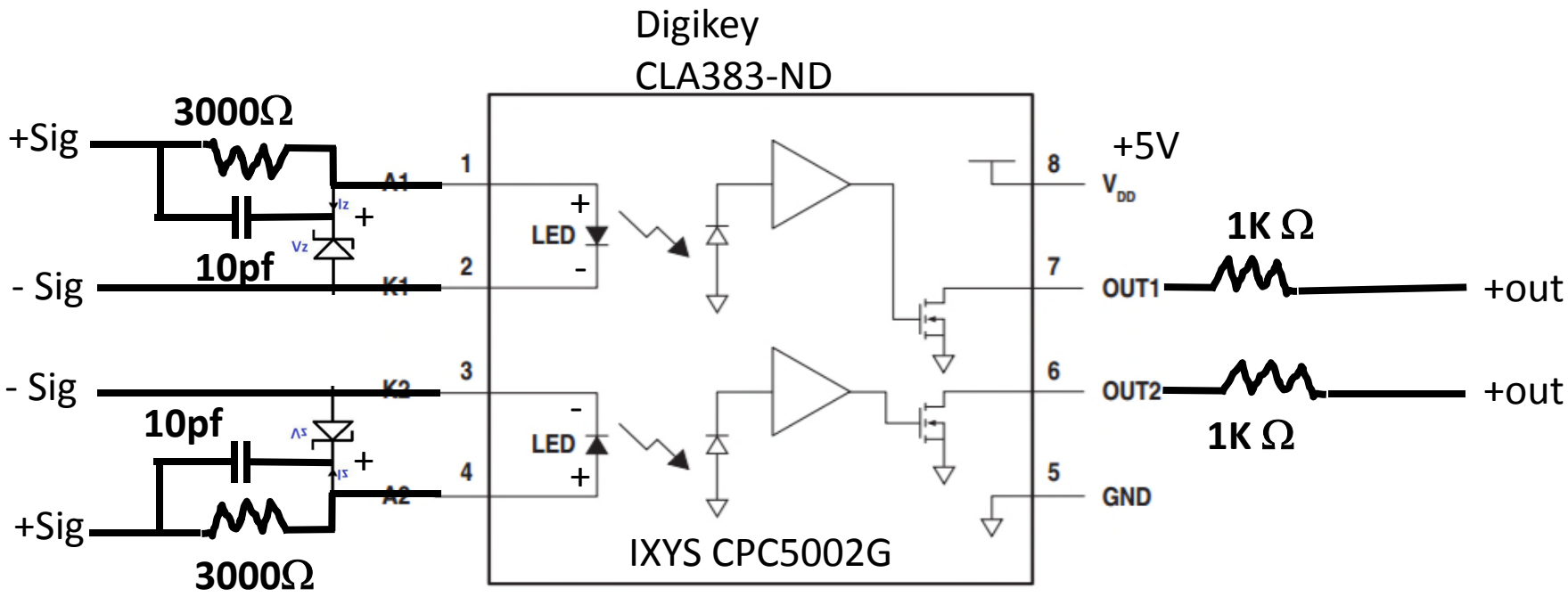


Output Connections



***NOTE:** The CIO-MINI37 has screw terminals. The diagram shows pin assignments on the SSR-RACK08. Numbers for the CIO-MINI37 and SSR-RACK08 are the same.

Optical Isolator Interface Circuit



NOTE: The function of the capacitors is to improve timing precision. Since precision is not essential in this design the capacitors were not implemented in the final circuit. (See technical note on chip for accurate info.)

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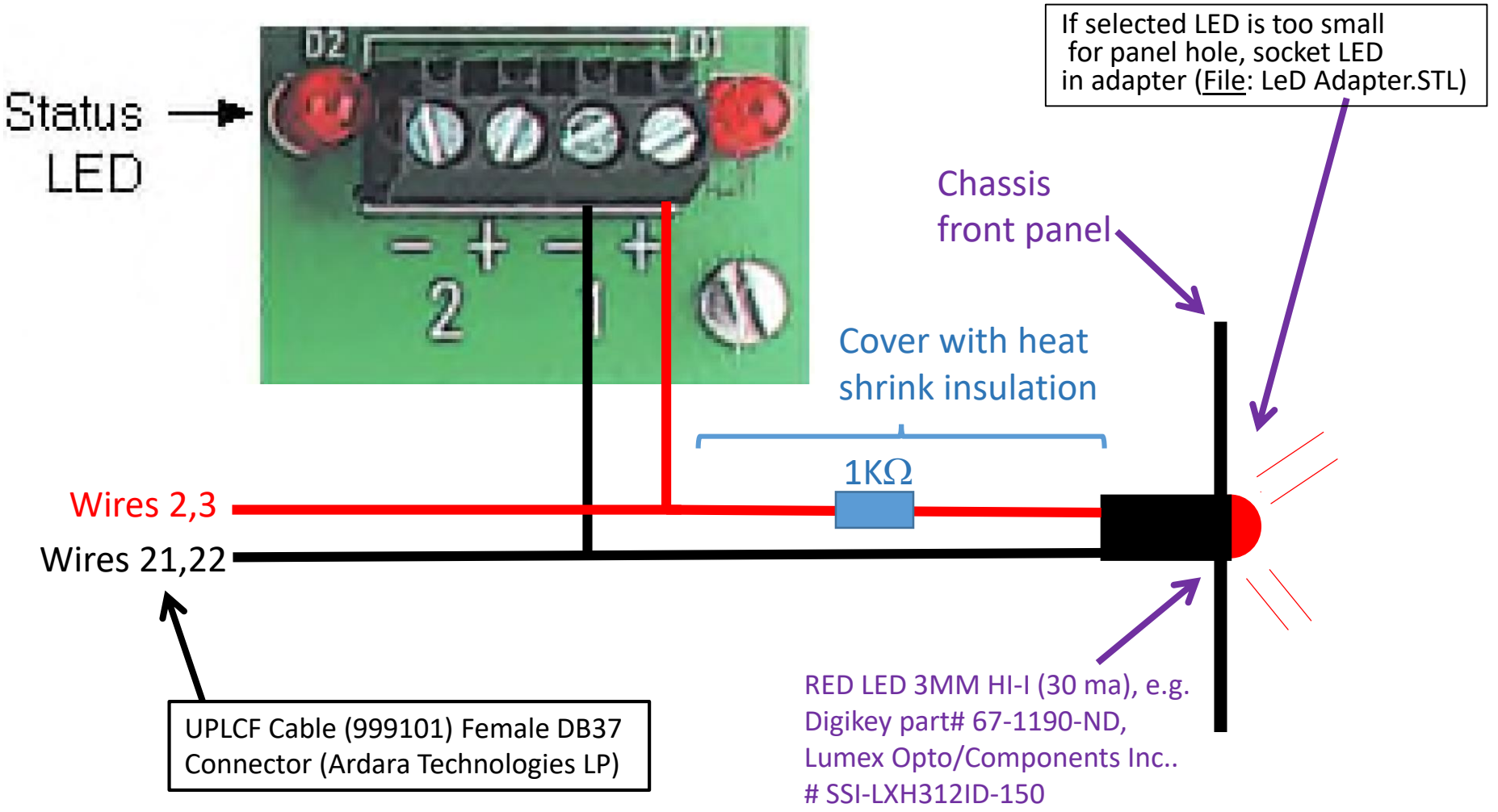
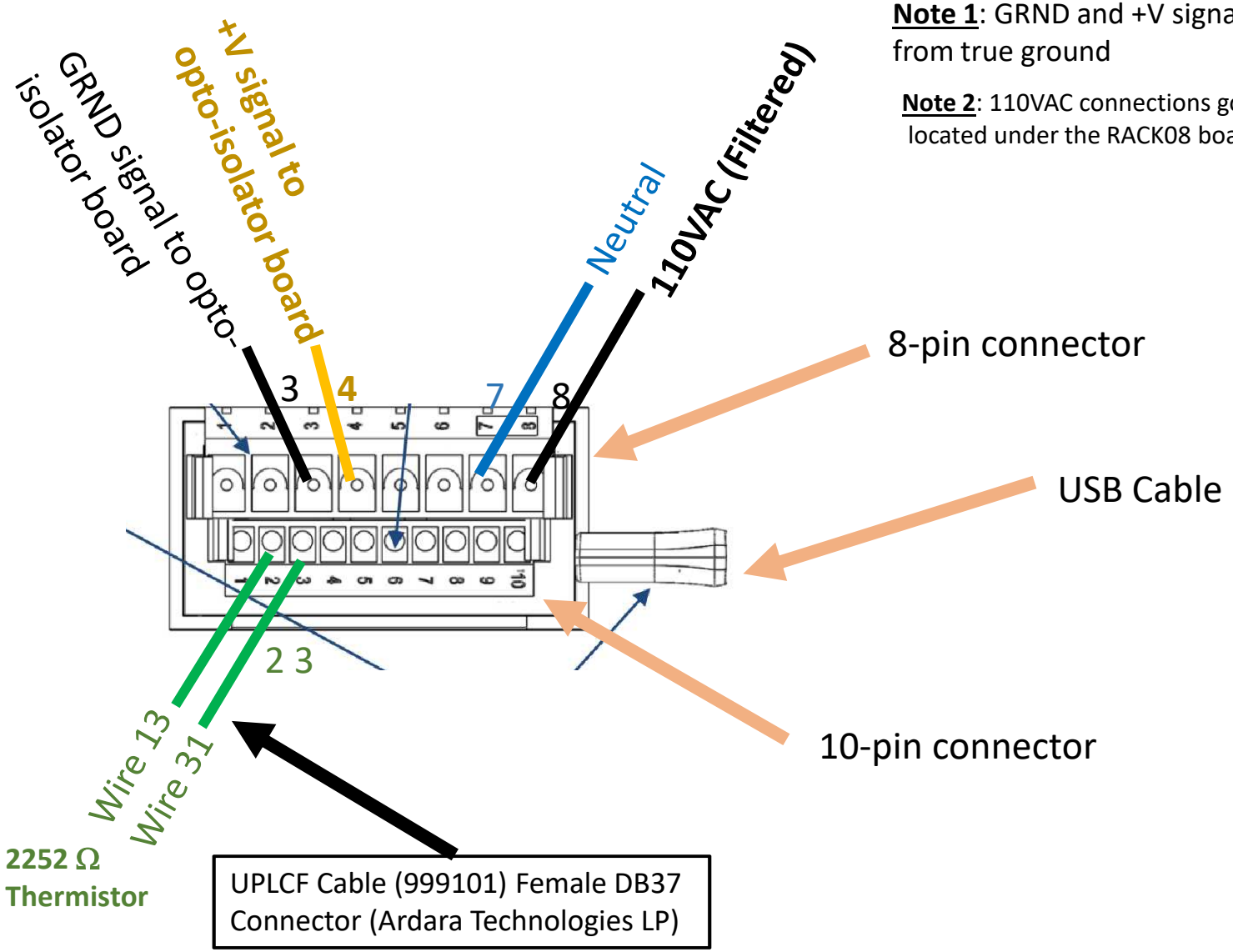
Detail of electrical connections on RACK08

-- Diagram shown applies to Heater channels 1 to 5.
-- Heater Channel 6 is connected to round (Leads A & B) on side panel



Wiring the CN32PT-440 Controller Units



Note 1: GRND and +V signal are isolated from true ground

Note 2: 110VAC connections go to barrier strip located under the RACK08 board.

T-Control Interface Channels

Channel	Function	Device Pins	RACK08 Output Connection
CN1507, Ch 1	-30 °C Chamber (RTD)		Channel 1
CN1507, Ch 2	+1 °C Chamber (RTD)		Channel 2
CN1507, Ch 3	---		
CN1507, Ch 4	-30 °C valve anti-frost Temp (RTD)		Channel 5
CN1507, Ch 5	+1 °C valve anti-frost temp (Thermistor)	Round connector to p11, p12	Channel 6 to round connector
CN1507, Ch 6	+1 °C Chamber exit fluid temp (RTD)		
CN1507, Ch 7	Cooling fluid entry temp. (RTD)		
DP32PT (Left)	Protease A temp (Thermistor)	p5 = 10V p6 = grn	Channel 4
DP32PT (Rt)	Protease B temp (Thermistor)	p5 = 10V p6 = grn	Channel 3

	A	B	C	D
1	**ZONE**	**FUNCTION**		**T-control Box Panel Mount #1: 37-PIN CONNECTOR (FEMALE)**
2	A	**Thermistor1(+)**		**19**
3	A	**Thermistor1(-)**		**37**
4	A	**Heater1(+)**		**2, 3**
5	A	**Heater1(-)**		**21, 22**
6	A	**Fan(+)**		**1**
7	A	**Fan(-)**		**20**
8	B	**Thermistor2(+)**		**18**
9	B	**Thermistor2(-)**		**36**
10	B	**Heater2(+)**		**4, 5**
11	B	**Heater2(-)**		**23, 24**
12	B	**Ground**		**12**
13	C(Top)	**Thermistor3(+)**		**17**
14	C(Top)	**Thermistor3(-)**		**35**
15	C(Top)	**Heater3(+)**		**6, 7**
16	C(Top)	**Heater3(-)**		**25, 26**
17	C(Top)	**Ground**		**30**
18	**C(Bot)**	**Thermistor4(+)**		**16**
19	C(Bot)	**Thermistor4(-)**		**34**
20	C(Bot)	**Heater4(+)**		**8, 9**
21	C(Bot)	**Heater4(-)**		**27, 28**
22	**D**	**Thermistor5(+)**		**15**
23	**D**	**Thermistor5(-)**		**33**
24	**D**	**Heater5(+)**		**10, 11**
25	**D**	**Heater5(-)**		**29**
26	E	**Thermistor6(+)**		**14**
27	E	**Thermistor65(-)**		**32**
28				
29	F	**Thermistor7(+)**		**13**
30	F	**Thermistor7(-)**		**31**

ZONE	FUNCTION	37-PIN CONNECTOR	LENGTH & WIRE GAUGE (IN)	TERMINATINGFEMALE CONNECTOR (PINS)	MALECONNECTOR (PINS)	TERMINATINGType
A (-30°C)	Thermistor1(+) Thermistor1(-) Heater1(+) Heater1(-) Fan1(+) Fan1(-) Ground			**9-pin SubD Female (A)** **1** **6** **2, 7** **3, 8** **5** **9** **8**	**9-pin SubD Male (A)** **1** **6** **2, 7** **3, 8** **5** **9** **8**	
B	Thermistor2(+) Thermistor2(-) Heater2(+) Heater2(-) Fan2(+) Fan2(-) Ground			**9-pin SubD Female (B)** **1** **6** **2, 7** **3, 8** **5** **9** **8**	**9-pin SubD Male (B)** **1** **6** **2, 7** **3, 8** **5** **9** **8**	
C(top)	Thermistor3(+) Thermistor3(-) Heater3(+) Heater3(-) Ground			**15-pin DIN Female (C)** (Amphenol FCI Part# G17S1500110EU) **1** **9** **2, 10** **3, 11** **4**	**15-pin DIN Male (C)** (Amphenol FCI Part# DA15P064TXLF) **1** **9** **2, 10** **3, 11** **4**	**Plastic Male Connector (D)** (Molex Part# 0050291758) 1 2 3 4
C(Bot)	Thermistor4(+) Thermistor4(-) Heater4(+) Heater4(-)			**15-pin DIN Female (C)** **8** **15** **6, 13** **7, 14**	**15-pin DIN Male (C)** **8** **15** **6, 13** **7, 14**	
D	Thermistor5(+) Thermistor5(-) Heater5(+) Heater5(-) Ground			**Plastic Female Connector(D)** (Molex Part# 0003062041) 1 2 3 4	**Plastic Male Connector (D)** (Molex Part# 0050291758) **1** **2** **3** **4**	

1 Inch = 2.54 cm

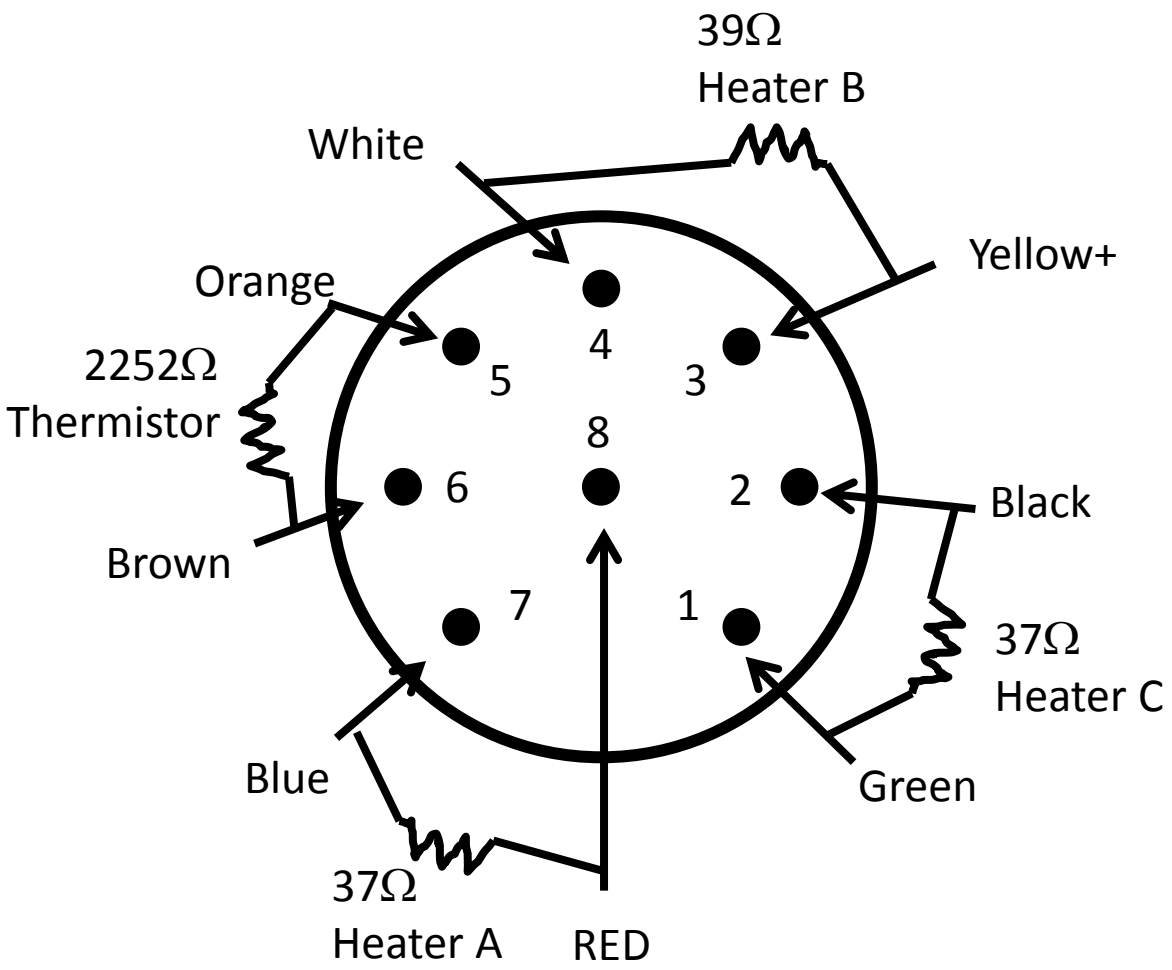
Diagram for 8-pin Connector and Cable at T-control Chassis

-- Page 18 shows a view of this connector.

Inside chassis connect together into two leads:

Lead A: 1, 8, 4
Lead B: 2, 3, 7

Leads A & B connect to Channel 6 of the RACK8 board.



1 Inch = 2.54 cm

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